GEOLOGY, ENERGY, AND MINERAL (GEM)
RESOURCE ASSESSMENT OF THE
GRANITE MOUNTAINS GEM RESOURCE AREA (GRA),
WYOMING, INCLUDING THE SWEETWATER ROCKS
WILDERNESS STUDY AREAS
(WY-030-120, WY-030-122, WY-030-123A AND WY-030-123B)

PHASE I

Contract No. YA-553-CT2-1055

Prepared for:

U.S. Bureau of Land Management

Prepared by:

Tetra Tech, Inc.
Pasadena, California

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EXECUTIVE SUMMARY

The U.S. Bureau of Land Management (BLM) has adopted a two-phase procedure for the integration of geologic, energy, and mineral (GEM) resources data concerning Wilderness Study Areas (WSAs). To facilitate this review, certain WSAs with similar geologic environments and mineral characteristics have been grouped into larger GEM Resource Areas (GRAs). Using these guidelines, the Sweetwater Rocks WSAs were grouped together into the larger Granite Mountains GRA. This report, which terminates the Phase I activities for the Granite Mountains GRA, is an evaluation and interpretation of existing data concerning the GEM resource potential in the WSAs.

The Granite Mountains GRA contains the Sweetwater Rocks WSAs: WY-030-120, WY-030-122, WY-030-123A, and WY-030-123B. The Sweetwater Rocks WSAs are located in the BLM's Lander Resource Area, Rawlins District, Wyoming.

Areas of the Sweetwater Rocks WSAs are considered to have a low to moderate to high favorability for the potential occurrence of uranium (classified 2D, 3D, 4D); these classifications are based upon an extensive evaluation of the uranium potential of this region of Wyoming (Griffin and Milton, 1980; Love, 1970). The uranium resource potential occurs in Tertiary fluvial sediments that drape the edge of the Precambrian rocks. The Sweetwater Rocks WSAs are considered to have a moderate favorability based on direct but quantitatively minimal evidence for the potential occurrence of jade (classified 3C). The jade resource potential occurs as small bodies in Precambrian rocks and in adjacent Tertiary rocks (Sinkankas, 1976; Madson, 1978); also, within the Tertiary sedimentary rocks, agate resources may appear. The WSAs are considered to have a low favorability based on indirect evidence for the potential occurrence of pumicite (classified 2B); pumicite may occur as beds in Tertiary volcaniclastic rocks. Vertebrate fossils are found within the sedimentary rock units of the upper part of the Split (Arikaree) Rock Formation of Tertiary age, which is adjacent to the Precambrian granitic rocks (Love, 1970). The potential for paleontologic resources is considered moderately high in the Tertiary rocks of the WSAs. Quantitatively minimal

direct evidence exists to support a low favorability classification for the potential occurrence of any other GEM resources (classified 2C). This classification is based upon the geologic environment and the inferred geologic processes that have been identified within the WSAs.

Additional investigations would help supplement the GEM resource evaluation of the Granite Mountains GRA. Additional detailed surface and particularly subsurface studies are strongly recommended to provide specific information on uranium within the Tertiary rocks adjacent to the Precambrian. These studies would provide valuable information to assist in making wilderness decisions. A considerable amount of geologic information was reviewed and interpreted for this report; this information needs to be reviewed in depth by BLM personnel to gain additional insight into the potential occurrence of GEM resources within the WSAs prior to making wilderness decisions.

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GEM RESOURCE AREA
GRANITE MOUNTAINS

1.0 INTRODUCTION

1.1 Purpose of Study

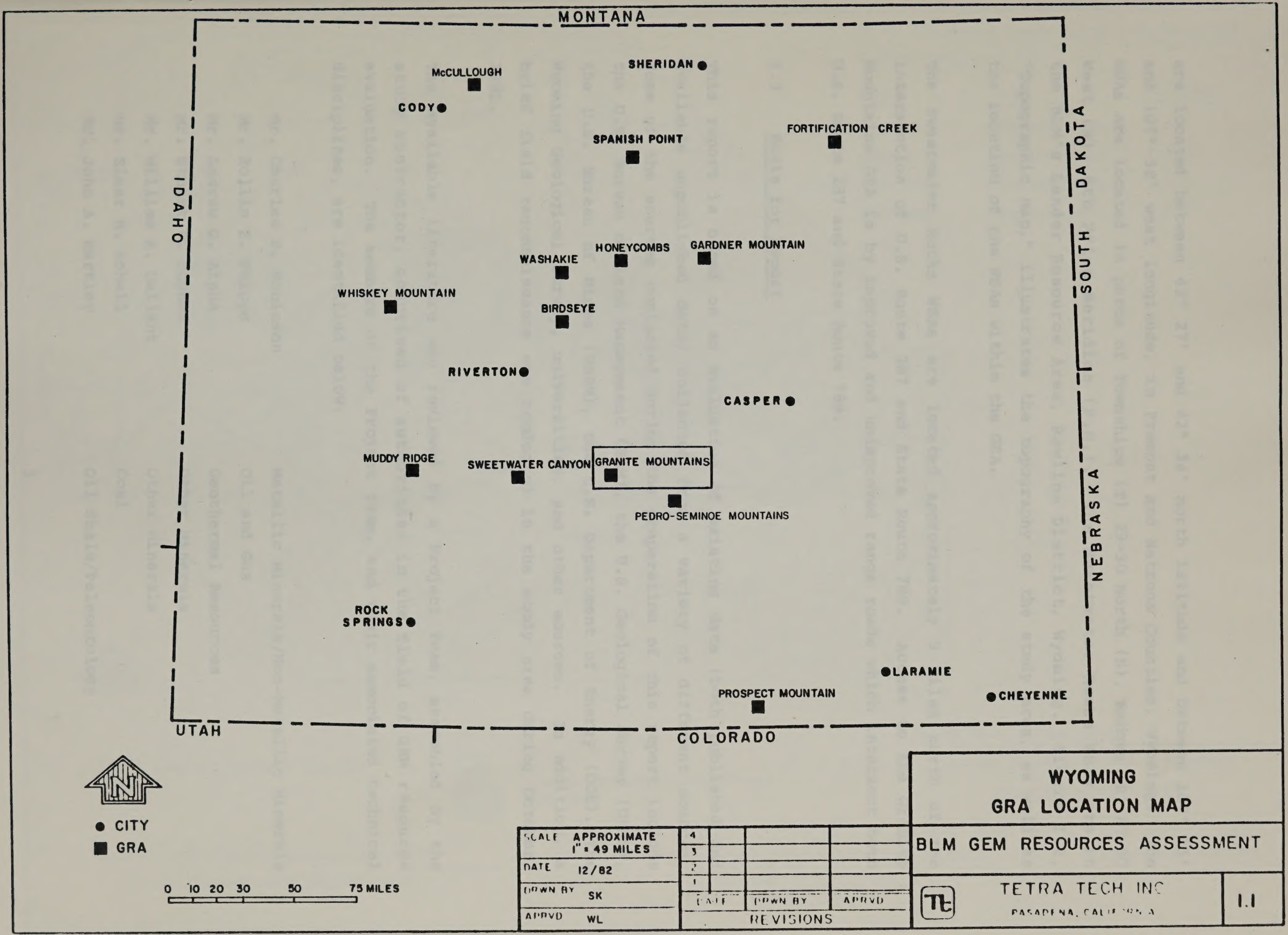
The U.S. Bureau of Land Management (BLM) has adopted a two-phase procedure for the integration of geologic, energy, and mineral (GEM) resources data for suitable/nonsuitable decisions concerning Wilderness Study Areas (WSAs). Phase I consists of a review and evaluation of existing data, resulting in an interpretation of the GEM resource potential of the WSAs. Phase II is designed to generate only the additional data required to support the GEM resource recommendations presented during Phase I. To facilitate this review, certain WSAs with similar geologic environments and mineral characteristics have been grouped together into larger GEM Resource Areas (GRAs). Using these guidelines, the Sweetwater Rocks WSAs were grouped together into the larger Granite Mountains GRA. This report, which terminates the Phase I activities for the Granite Mountains GRA, is an evaluation and interpretation of existing data concerning the GEM resource potential in the Sweetwater Rocks WSAs.

The GEM resources evaluations for this study were performed by Tetra Tech, Inc. for the U.S. Bureau of Land Management, under Contract No. YA-553-CT2-1055. This study was completed in January, 1983.

1.2 Location and Access

This GEM report covers the area identified as the Granite Mountains GEM Resource Area (GRA); the geographic location of the study area is shown in Figure 1.1, "GRA Location Map."

The Granite Mountains GRA contains all the Sweetwater Rocks Wilderness Study Areas (WSAs): WY-030-120 (6,316 acres); WY-030-122 (12,789 acres); WY-030-123A (7,041 acres); and WY-030-123B (6,429 acres). The Sweetwater Rocks WSAs



WYOMING
GRA LOCATION MAP

BLM GEM RESOURCES ASSESSMENT

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1.1

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are located between 42° 27' and 42° 34' north latitude and between 107° 15' and 107° 38' west longitude, in Fremont and Natrona Counties, Wyoming. The WSAs are located in parts of Townships (T) 29-30 North (N), Ranges (R) 87-90 West (W), 6th Prime Meridian (P.M.). The Sweetwater Rocks WSAs are in the BLM's Lander Resource Area, Rawlins District, Wyoming. Figure 1.2, "Topographic Map," illustrates the topography of the study area, as well as the location of the WSAs within the GRA.

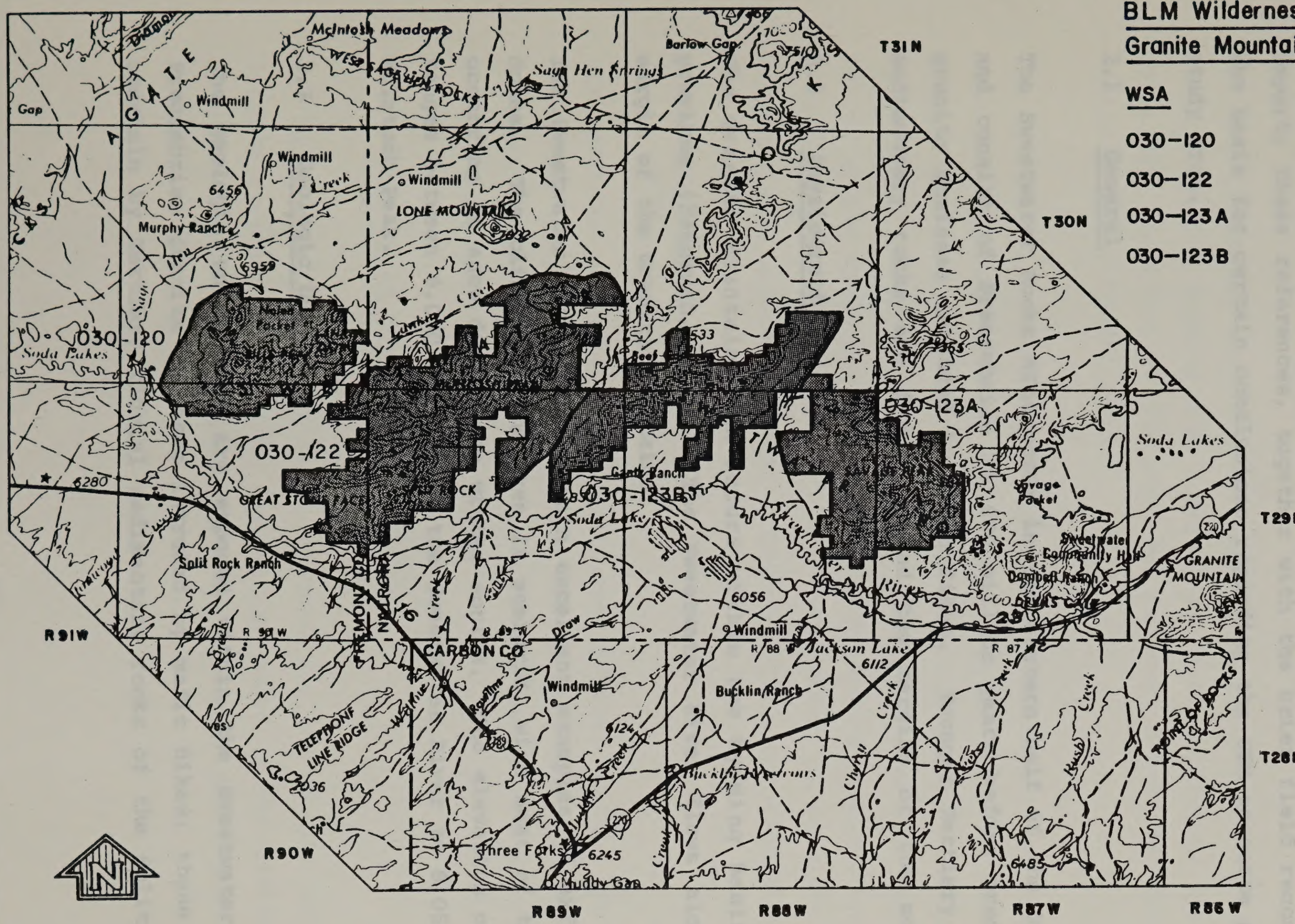
The Sweetwater Rocks WSAs are located approximately 9 miles north of the intersection of U.S. Route 287 and State Route 789. Access to the Granite Mountains GRA is by improved and unimproved range roads which intersect both U.S. Route 287 and State Route 789.

1.3 Basis for Report

This report is based on an evaluation of existing data (both published and available unpublished data) collected from a variety of different sources. Some of the sources contacted during the preparation of this report include the U.S. Bureau of Land Management (BLM), the U.S. Geological Survey (USGS), the U.S. Bureau of Mines (USBM), the U.S. Department of Energy (DOE), the Wyoming Geological Survey, universities, and other sources. In addition, a brief field reconnaissance was conducted in the study area during October, 1982.

The available literature was reviewed by a Project Team, assembled by the study contractor, comprised of authorities in the field of GEM resource evaluation. The members of the Project Team, and their associated technical disciplines, are identified below:

Mr. Charles S. Robinson	Metallic Minerals/Non-Metallic Minerals
Mr. Rollin E. Phipps	Oil and Gas
Mr. Andrew G. Alpha	Geothermal Resources
Mr. Stuart P. Hughes	Other Minerals
Mr. William A. Gallant	Other Minerals
Mr. Elmer M. Schell	Coal
Mr. John A. Hartley	Oil Shale/Paleontology



BLM Wilderness Study Areas Included in the Granite Mountains GRA

WSA	NAME	ACREAGE
030–120	Sweetwater Rocks	6,316
030–122	Sweetwater Rocks	12,789
030–123 A	Sweetwater Rocks	7,041
030–123 B	Sweetwater Rocks	6,429

(USGS, 1955; revised, 1974)

NOTE: Contours in 200ft. Intervals

▨ Approximate Boundary of Wilderness Study Area

5 4 3 2 1 0 3 6 Miles

5 4 3 2 1 0 5 10 Kilometers

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Granite Mountains GRA, Wyoming

TOPOGRAPHIC MAP

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FIGURE 1.2

2.0 GEOLOGY

The geology of the area is illustrated on the Casper 1° x 2° Geologic Map (Love et al., 1979), and in the "Cenozoic Geology of the Granite Mountains Area" (Love, 1970). Numerous other authors have discussed the mineral resources of the Granite Mountains area. A list of these maps and reports is presented in the references and selected bibliography section of this report; these references, together with the brief field reconnaissance, form the basis for certain conclusions regarding the GEM resource potential in the study area.

2.1 General

The Sweetwater Rocks WSAs occur in the eastern half of the Granite Mountains and consist of Precambrian (> 600 million years before present [m.y.B.P.]) granite gneisses intruded by mafic dikes. Younger Tertiary (< 70 m.y.B.P.) sedimentary rocks are draped around the margins of the mountainous area.

2.2 Physiography

The Granite Mountains GRA occurs within the Wyoming Basin physiographic province (Fenneman, 1931). The Sweetwater River flows along the southern margin of the Granite Mountains.

The Sweetwater Rocks WSAs contain excellent examples of exfoliating granite domes. The climate of the area is semiarid, with most of the precipitation occurring as snow during the winter months. The elevation of the study area ranges between 6,000 feet along the Sweetwater River to 8,058 feet on top of McIntosh Peak.

2.3 Geologic Units

The geologic units that are exposed within the Sweetwater Rocks WSAs are Precambrian granite gneisses intruded by mafic dikes; these dikes have been overlain by Tertiary fluvial sedimentary rocks of the Split Rock (Arikaree)

and Moonstone Formations. Figure 2.1, "Geologic Map," delineates the bedrock geologic formations that occur within the GRA. Figure 2.2, "Generalized Stratigraphic Column," is a generalized stratigraphic column which gives a brief description of all the stratigraphic units that underlie the Granite Mountains GRA.

2.3.1 Bedrock Units

The major bedrock unit in the area is a Precambrian age medium to coarse grained biotite granite with numerous dikes of aplite and pegmatite. Shortly after the formation of the granite, basaltic dikes intruded along zones of weakness in the cooled mass.

The Miocene (11-25 m.y.B.P.) Split Rock Formation crops out around all the WSAs and consists of less than 1,000 feet of white to tan, fine to coarse grained sandstones and conglomerates. When occurring in eastern Wyoming, the Split Rock Formation is sometimes referred to as the Arikaree Formation. Overlying the Split Rock Formation is the Moonstone Formation. The Moonstone Formation can be as much as 1,350 feet thick; it consists of interlayered sandstones, limestones, tuffs, conglomerates, and claystones (Love, 1970).

2.3.2 Surficial Deposits

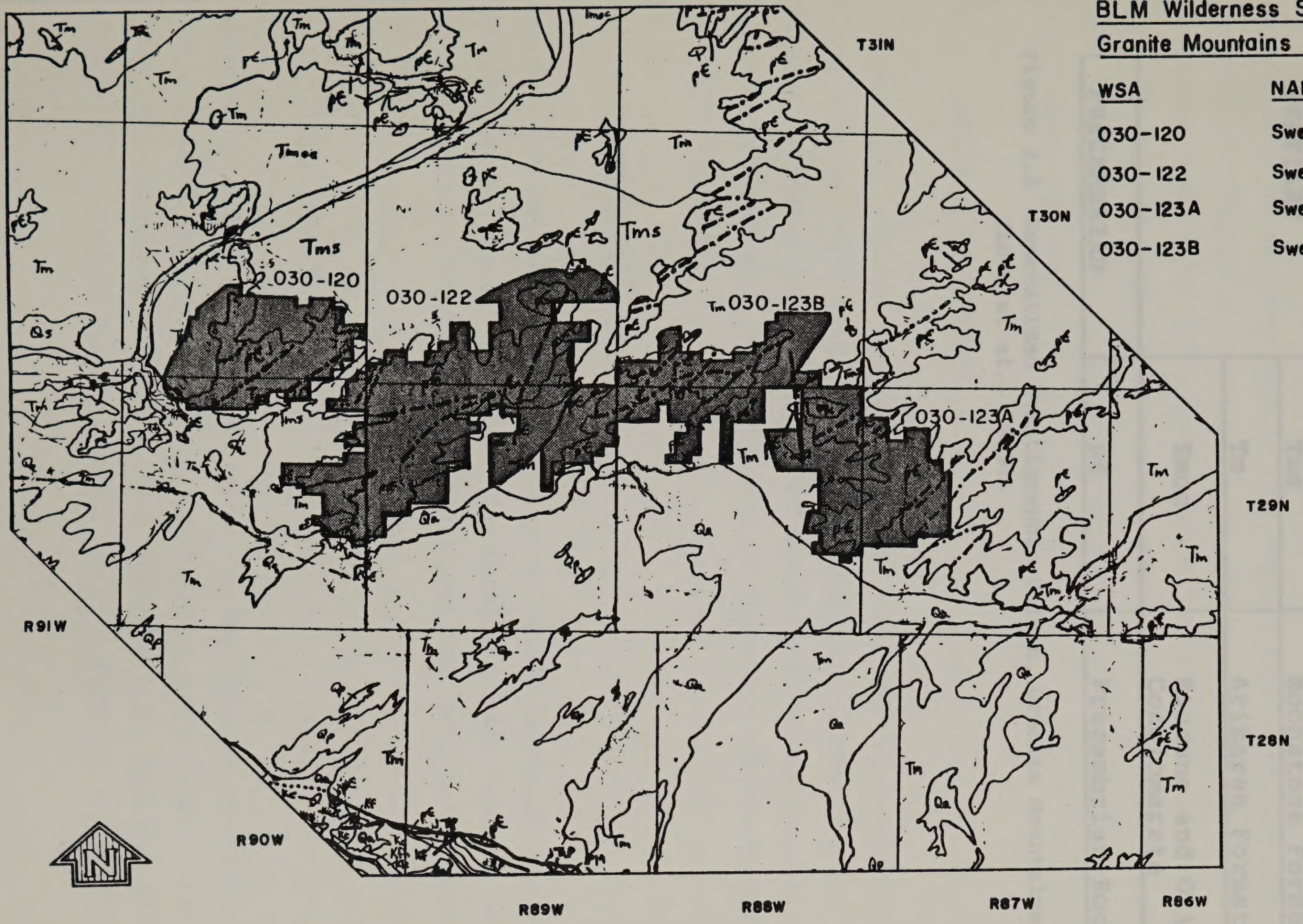
The surficial deposits in the study area consist of thin deposits of boulders along the margins of the mountain areas, and deposits of reworked Tertiary material deposited by the streams of the area. Other surficial deposits include rock slide debris and talus.

2.4 Structural Geology

The uplift and thrusting which occurred in the region during the Laramide orogeny resulted in exposing Precambrian rocks in the Sweetwater Rocks WSAs. This uplift and thrusting is evidenced today by the South Granite Mountains

BLM Wilderness Study Areas Included in the Granite Mountains GRA

WSA	NAME	ACREAGE
030-120	Sweetwater Rocks	6,316
030-122	Sweetwater Rocks	12,789
030-123A	Sweetwater Rocks	7,041
030-123B	Sweetwater Rocks	6,429



(LOVE et al.,1979)

▨ Approximate Boundary of Wilderness Study Area

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Granite Mountains GRA, Wyoming

GEOLOGIC MAP

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PASADENA, CALIFORNIA

FIGURE 2.1

SYSTEM	SYMBOL	FORMATION
QUATERNARY	Qa	Alluvium
	Qp	Pediment Gravel
TERTIARY	Tms	Moonstone Formation
	Tm	Arikaree Formation
	Tmoc	Miocene and Oligocene Conglomerate
PRECAMBRIAN	pЄ	Precambrian Rocks

Figure 2.2 Generalized Stratigraphic Column, Granite Mountains GRA (Love et al., 1979).

and North Granite Mountains fault system. The Granite Mountains uplift is elongate and trends west-northwest between the Wind River uplift on the west and the Laramie uplift on the east. The Archean rocks, flanked by folded Paleozoic (225 m.y.B.P.) and Mesozoic (70-225 m.y.B.P.) rocks, were covered by Tertiary sediments (Split Rock (Arikaree) and Moonstone Formations), and partly exhumed in the late Tertiary; this last event exposed the Granite Mountains as we see them today. The Granite Mountains and adjacent ranges are depleted of radiogenic isotopes at the surface; it is assumed that the Granite Mountains have acted as a source rock for much of the sedimentary uranium deposits in the region. Therefore, the adjacent Tertiary sedimentary rocks that drape the edges of the Precambrian should be considered highly favorable for uranium deposits.

2.5 Engineering Geology

The geologic hazards identified within the WSAs include rockfall and rock slide hazards associated with the Precambrian, flash flooding in the intermittent drainages during periods of short term intense rainfall, and swelling soils associated with the weathering of tufaceous sediments from the Tertiary sedimentary rocks.

2.6 Paleontologic Resources

Abundant Miocene vertebrate fossils occur in the uppermost member of the Split Rock (Arikaree) Formation around the margins of the Granite Mountains (Love, 1970). However, vertebrate localities are not known within the boundaries of the WSAs.

2.7 Historical Geology

Amphibolite grade metamorphic rocks in the Granite Mountains were derived from eugeosynclinal, sedimentary, and volcanic rocks approximately 2.9 billion years ago (Stuckless, 1977). The granites were derived from the partial melting of a garnetiferous crustal rock. Nephrite and diabase dikes were

intruded into the granitic rocks a few tens of millions of years after emplacement of the granite.

Uplift and thrusting during the Laramide orogeny caused exposure of the Granite Mountains and the shedding of abundant sediments which blanketed the region. Subsequent erosion and weathering caused migration of uranium rich groundwaters to develop roll fronts and other sedimentary uranium deposits within the region.

3.0 ENERGY AND MINERAL RESOURCES

3.1 General

The known and potential resources of the Granite Mountains GRA include uranium, thorium, pumicite, jade, agate, and vermiculite.

Figure 3.1, "Mineral Occurrence Map," illustrates the locations of any known past and present mines, and occurrences of mineral deposits and GEM resources within the GRA. Information for this figure came from the USGS' Computerized Resource Information Bank (CRIB); the USBM's Minerals Availability Information System (MILS); the DOE's Uranium Resource Evaluation of the Casper Quadrangle (Griffin and Milton, 1980); and the Wyoming Mines and Mineral Map (Hausel et al., 1979).

3.2 Known Resources

The known resources of the Sweetwater Rocks WSAs include uranium and thorium occurrences associated with pegmatites in the Precambrian rocks. Uranium occurrences are also associated with the Tertiary sedimentary sequence which is draped around the Sweetwater Rocks WSAs. Pumicite in some of the Tertiary volcaniclastic rocks, as well as sodium carbonate and sodium sulfate associated with evaporative lake deposits, occur within the GRA adjacent to the WSAs. Greenstone belt metallic mineralization appears to exist further to the west, outside of the WSAs. Jade occurs as dikes in the Precambrian rocks

BLM Wilderness Study Areas Included in the Granite Mountains GRA

WSA	NAME	ACREAGE
030-120	Sweetwater Rocks	6,316
030-122	Sweetwater Rocks	12,789
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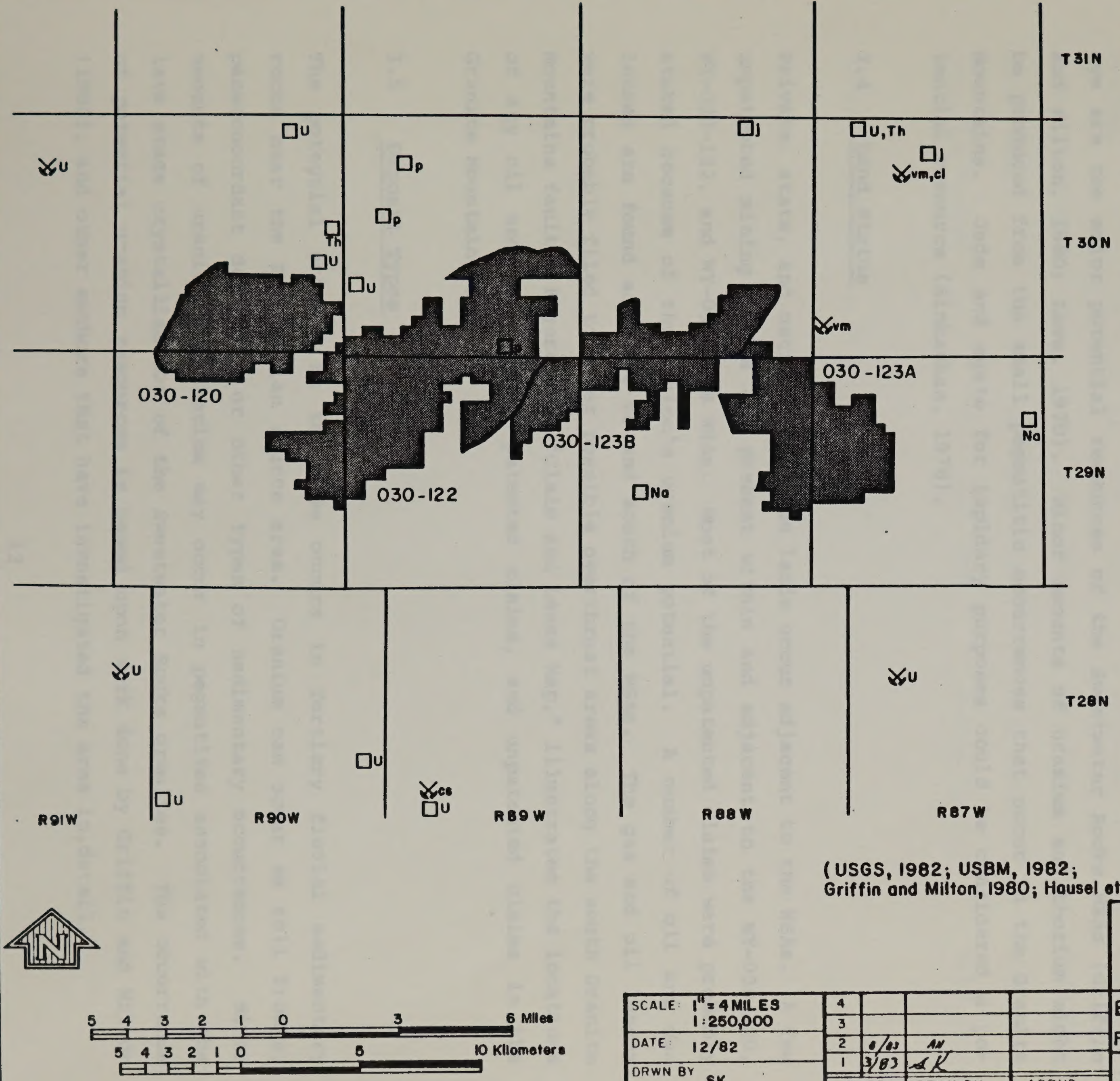
030-123B	Sweetwater Rocks	6,429



(USGS, 1982; USBM, 1982; Griffin and Milton, 1980; Hausel et al., 1979)

●	Oil Well
☼	Gas Well
✹	Oil & Gas Well
⚒	Mine
✕	Inactive Mine
■	Ore Body
◧	Deposit
☐	Occurrence
▇	Approximate Boundary of Wilderness Study Area

COMMODITY

Na	Sodium carbonate-sulfate
Th	Thorium
U	Uranium
p	Pumicite
J	Jade
vm	Vermiculite
cl	Clay
cs	Construction Stone

Granite Mountains GRA, Wyoming

MINERAL OCCURRENCE MAP

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FIGURE 3.1

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and as detrital boulders in the younger Tertiary Formations. Agate is also common within the sedimentary units that surround the WSAs. Vermiculite occurs adjacent to the WSAs. Table 3.1, "Uranium Occurrences," lists the known uranium occurrences in the Granite Mountains GRA (Griffin and Milton, 1980).

3.3 Potential Resources

The potential uranium resources in the fluvial sedimentary rocks of Tertiary age are the major potential resources of the Sweetwater Rocks WSAs (Griffin and Milton, 1980; Love, 1970). Minor amounts of uranium and thorium might be produced from the small pegmatitic occurrences that occur in the Granite Mountains. Jade and agate for lapidary purposes could be considered a potential resource (Sinkankas, 1976).

3.4 Land Status

Private, state, and national resource lands occur adjacent to the WSAs. A few unpatented mining claims are present within and adjacent to the WY-030-120, WY-030-122, and WY-030-123B WSAs. Most of the unpatented claims were probably staked because of the region's uranium potential. A number of oil and gas leases are found adjacent to and south of the WSAs. The gas and oil leases were probably filed to cover possible overthrust areas along the south Granite Mountains fault. Figure 3.2, "Claim and Lease Map," illustrates the locations of any oil and gas leases, patented claims, and unpatented claims in the Granite Mountains GRA.

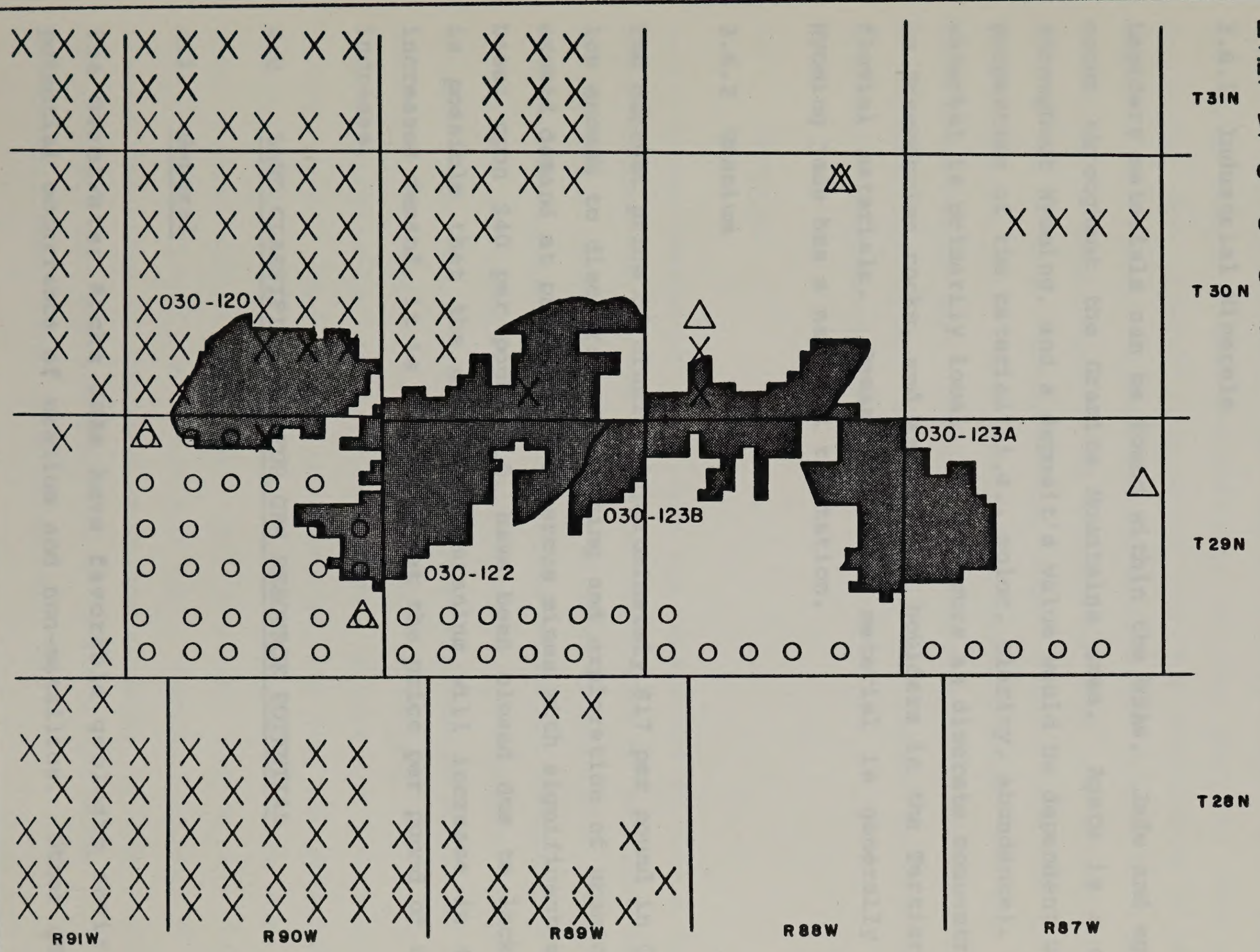
3.5 Deposit Types

The potential uranium in the area occurs in Tertiary fluvial sedimentary rocks near the Precambrian source area. Uranium can occur as roll fronts, peneconcordant deposits, or other types of sedimentary occurrences. Minor amounts of uranium and thorium may occur in pegmatites associated with the late stage crystallization of the Sweetwater Rocks granites. The occurrence of potential uranium resources is based upon work done by Griffin and Milton (1980), and other authors that have investigated the area in detail.

Table 3.1
Uranium Occurrences
Granite Mountains GRA

	Location				Host Rock	Production of U_3O_8
Name	1/4 Sec.	Sec.	Twp.	Rng.	Formation/Member	(in lbs.)
Unknown	NE	24	30W	90W	Moonstone	0-20,000
Gap Claims	NW	25	28N	90W	Precambrian quartz monzonite	0-20,000
Unknown	S	11	30N	91W	Arikaree	0-20,000
Sage Bed Creek	S	2	30W	90W	Moonstone	0-20,000
Split Rock	S	30	30N	89W	Wind River	0-20,000
Lucky 13 Claims	S	31	28N	90W	Battle Spring	0-20,000

(Griffin and Milton, 1980)



BLM Wilderness Study Areas Included in the Granite Mountains GRA

WSA	NAME	ACREAGE
030-120	Sweetwater Rocks	6,316
030-122	Sweetwater Rocks	12,789
030-123A	Sweetwater Rocks	7,041
030-123B	Sweetwater Rocks	6,429

○ Oil & Gas Lease

△ Patented Claim

X Unpatented Claim

▨ Approximate Boundary of Wilderness Study Area

NOTE: Symbols illustrate those sections where claims or leases are present

5 4 3 2 1 0 3 6 Miles

5 4 3 2 1 0 5 10 Kilometers

(BLM, 1982)

Granite Mountains GRA, Wyoming

CLAIM and LEASE MAP

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FIGURE 3.2

The potential occurrence of jade and agate in the region is based upon studies by Madson (1978), Sinkankas (1976), and a brief field verification conducted for the present study. Jade occurs as dikes and concentrations in Precambrian rock, and together with agate as detrital boulders in Tertiary age sediments. The agate probably developed as thin beds in the Tertiary age sedimentary rocks from groundwater.

3.6 Resource Economics

3.6.1 Industrial Minerals

Lapidary materials can be found within the WSAs. Jade and agate are known to occur throughout the Granite Mountains area. Agate is a common commodity throughout Wyoming, and a deposit's value would be dependent upon the physical properties of the material (i.e., color, clarity, abundance). Demand for this material is primarily local. Jade occurs as discrete concentrations and dikes in Precambrian rocks, and as detrital boulders in the Tertiary and Quaternary fluvial materials. Demand for this material is generally local, although Wyoming jade has a national reputation.

3.6.2 Uranium

The current price of uranium (approximately $17 per pound in October, 1982) is low enough to discourage the mining and exploration of uranium. Reserves far exceed demand at present and numerous mines with significant measured reserves based upon $40 per pound U_3O_8 have been closed due to lack of demand. It is possible that the demand for uranium will increase in the future; with increased demand, it is probable that the price per pound of uranium will also increase.

4.0 LAND CLASSIFICATION FOR GEM RESOURCE POTENTIAL

4.1 General

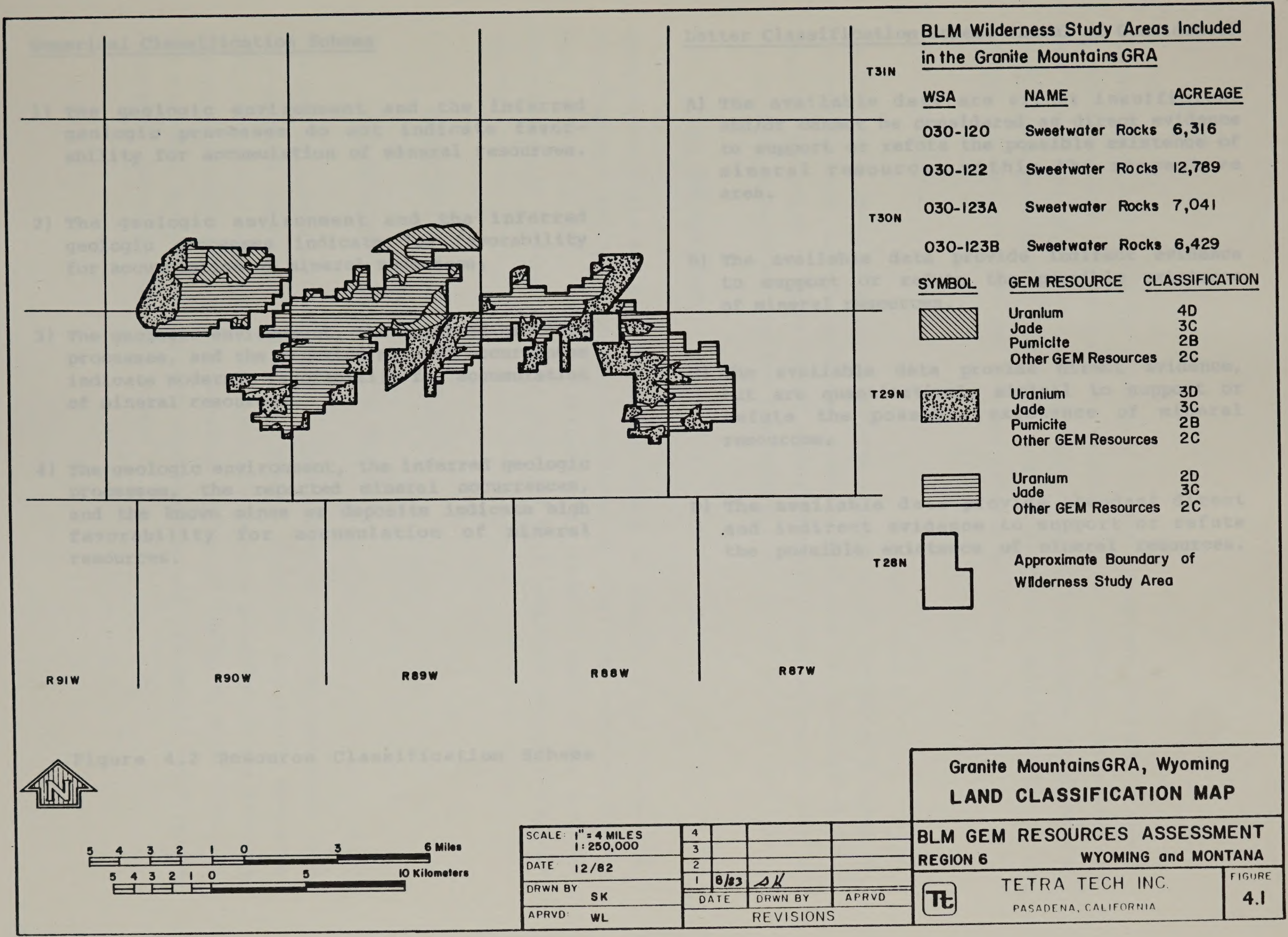
The Sweetwater Rocks WSAs have favorable geologic environments for the potential occurrence of uranium and non-metallics. Other GEM resources such

as coal, metallics, oil, gas, and geothermal resources, have low or unevaluated potentials for occurrences in the WSAs; these potentials are based upon a review of the available literature, the potential geologic environments, and the brief field reconnaissance.

In order to better evaluate the occurrence or potential occurrence of resources in the GRA, a 2-part resource classification scheme has been adopted. Each resource or potential resource within the GRA will receive an alphanumeric classification. The number classification will range from 1 to 4, and will indicate the favorability of the geologic environment, geologic processes, and mineral occurrences for the occurrence of a particular resource. The letter classification will range from A to D and will indicate the level of confidence to be associated with the numerical classification. Figure 4.1, "Land Classification Map," illustrates the areas of potential GEM resources with their assigned classifications for the WSAs within the Granite Mountains GRA. Figure 4.2, "Resource Classification Scheme," provides a detailed description of the number and letter designations used in the resource classification scheme.

4.2 Uranium

Areas of the Sweetwater Rocks WSAs are considered to have a low to moderate to high favorability for the potential occurrence of uranium, depending upon the geologic environment. There is a high favorability for the potential occurrence of uranium in the Moonstone Formation (classified 4D); this classification is based on abundant direct and indirect evidence (Griffin and Milton, 1980; Love, 1970). There is a moderate favorability for the potential occurrence of uranium in the Split Rock (Arikaree) Formation (classified 3D); this classification is based on abundant direct and indirect evidence similar to the above. There is a low favorability for the potential occurrence of uranium in the Precambrian rocks of the Sweetwater Rocks WSAs (classified 2D); this classification is based upon abundant direct and indirect evidence. These classifications are based upon numerous intensive studies on the mineral resources of the Granite Mountains area, and the presence of favorable environments for the accumulation of uranium resources in the WSAs (Griffin and Milton, 1980; Love, 1970; Stuckless, 1977).



BLM Wilderness Study Areas Included in the Granite Mountains GRA

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030-120	Sweetwater Rocks	6,316
030-122	Sweetwater Rocks	12,789
030-123A	Sweetwater Rocks	7,041
030-123B	Sweetwater Rocks	6,429

SYMBOL	GEM RESOURCE	CLASSIFICATION
▨	Uranium Jade Pumicite Other GEM Resources	4D 3C 2B 2C
▦	Uranium Jade Pumicite Other GEM Resources	3D 3C 2B 2C
☰	Uranium Jade Other GEM Resources	2D 3C 2C
☐	Approximate Boundary of Wilderness Study Area	

Granite Mountains GRA, Wyoming

LAND CLASSIFICATION MAP

BLM GEM RESOURCES ASSESSMENT

REGION 6 WYOMING and MONTANA

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FIGURE 4.1

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Numerical Classification Scheme

1) The geologic environment and the inferred geologic processes do not indicate favorability for accumulation of mineral resources.

2) The geologic environment and the inferred geologic processes indicate low favorability for accumulation of mineral resources.

3) The geologic environment, the inferred geologic processes, and the reported mineral occurrences indicate moderate favorability for accumulation of mineral resources.

4) The geologic environment, the inferred geologic processes, the reported mineral occurrences, and the known mines or deposits indicate high favorability for accumulation of mineral resources.

Letter Classification Scheme (Level of Confidence)

A) The available data are either insufficient and/or cannot be considered as direct evidence to support or refute the possible existence of mineral resources within the respective area.

B) The available data provide indirect evidence to support or refute the possible existence of mineral resources.

C) The available data provide direct evidence, but are quantitatively minimal to support or refute the possible existence of mineral resources.

D) The available data provide abundant direct and indirect evidence to support or refute the possible existence of mineral resources.

Figure 4.2 Resource Classification Scheme

4.3 Jade

The Sweetwater Rocks WSAs are considered to have a moderate favorability based on direct but quantitatively minimal evidence for the potential occurrence of jade (classified 3C); this classification is based upon studies by Sinkankas (1976) and Madson (1978). Jade occurs as either vein or dike deposits, or as detrital concentrations in the Tertiary sedimentary rocks.

4.4 Pumicite

The Sweetwater Rocks WSAs are considered to have a low favorability based on indirect evidence for the potential occurrence of pumicite (classified 2B); this classification is based upon a number of small, localized occurrences in the Tertiary rocks within the GRA (see Figure 3.1).

4.5 Other GEM Resources

Quantitatively minimal direct evidence exists to support a low favorability classification for the potential occurrence of other GEM resources in the WSAs (classified 2C). This classification is based in part on the geologic environment and inferred geologic processes that have been identified within the WSAs.

5.0 RECOMMENDATIONS FOR FURTHER WORK

5.1 Work Recommended to Complete Data Base

A number of investigations could be implemented to generate additional data to supplement the conclusions of this Phase I report for the Granite Mountains GRA. Additional work needed to verify the uranium potential of the Tertiary sedimentary rocks would include detailed mapping of the Split Rock (Arikaree) and Moonstone Formations, and rock chip sampling and radiometric traverses to confirm or define the favorable areas.

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